Removing Hydrocarbons/Organic Contaminants from Water Using a Novel Ultrahydrophobic/Oleophilic Self-Cleaning Polypropylene Material

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The widespread use of petrochemicals often leads to substance spills in aquatic environments during transfers or offshore drilling/exploration, resulting in catastrophic pollution, economical loss, and impact on aquatic ecosystems. According to the International Tanker Owners Pollution Federation, more than 7.3 billion liters of petrochemicals were lost as a result of tanker incidents from 1970 to 2018. The best reported conventional separation methods are on average 60% efficient and the petrochemicals extracted are chemically altered, losing their characteristics and value. This research aims to use hydrophobic functionalized polypropylene with WO3 and Multi Walled Carbon Nanotubes (MWCNT) in the separation of hydrocarbons/organic contaminants from water. The novel composite was synthesized by mixing MWCNT, WO3 and polypropylene homogenously. An Easy-load Masterflex Tubing Model with the composite inside one end was used to conduct the separation process. The final volume of both substances shows that the composite was able to achieve a high separation efficiency of 99%. Each 100 grams of the composite was successfully able to separate more than 6,535 L/m2/h of petrochemicals from water without chemical alteration. Regeneration was conducted on four hydrocarbons for 20-cycles/each components, which showed that the composite does not lose its ultra-hydrophobicity and functionality over time. A feasibility study indicated that the cost to manufacture the composite is significantly lower when compared to conventional methods. This study proved that the composite was highly efficient and cost effective, yielding a new novel system to successfully remove petrochemicals from aquatic environments.

Awards Won:
Fourth Award of $500